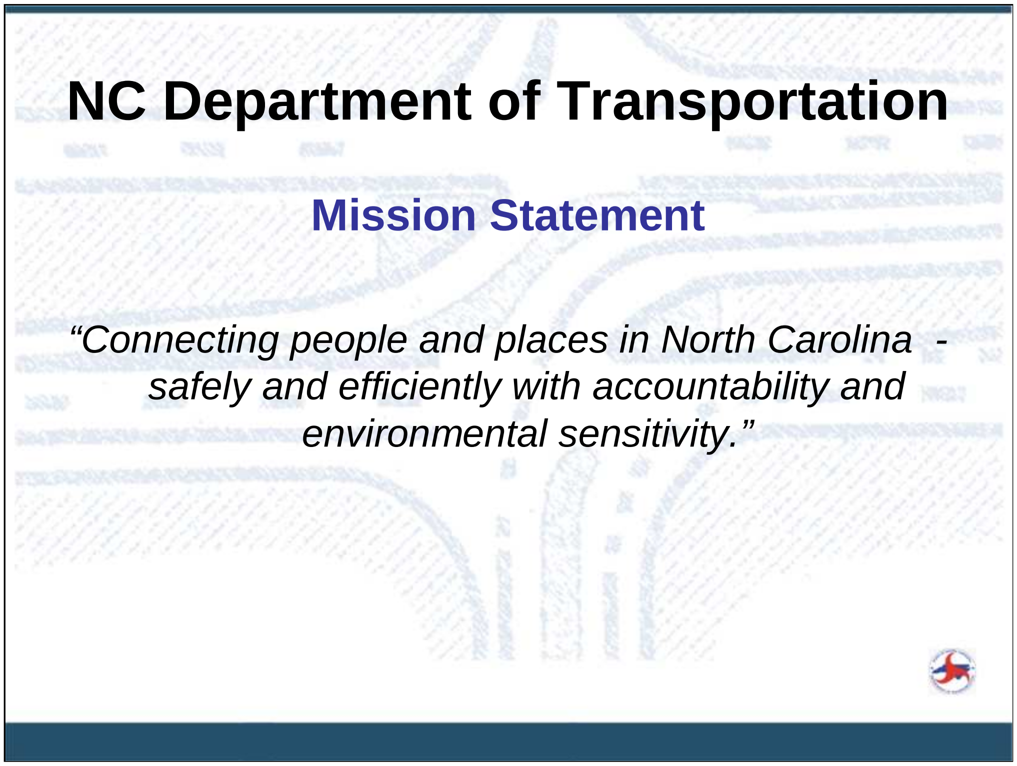
Good morning and Welcome!

Before I begin, I want to take this opportunity to thank you for coming and welcome you on behalf of the North Carolina Department of Transportation to our presentation on the "**superstreet**". We are really excited to be here today to share one way your Department of Transportation is addressing the needs of our State's transportation system and leading the country in innovative design techniques.

The **superstreet** concept refers to a reconfiguration of the traditional intersection. This idea has been used in different parts of the country to alter traffic flow when safety and delay at intersections would benefit from its use. The North Carolina Department of Transportation has supported the development of a “new” application of the **superstreet** that was implemented on a section of roadway near Leland, North Carolina along US 17 in 2007. This application was considered to be the first signalized **superstreet** in the nation. Today, we have plans to apply this concept to locations across the State. Thus, the **superstreet** is now considered a new tool in the Department of Transportation’s tool box. It is a means to relieve the effects of congestion along our roadways and protect our environment by improving air quality along congested corridors. As an added bonus, it can significantly reduce the cost of construction to roadway projects that might otherwise require large interchanges to handle traffic demands.

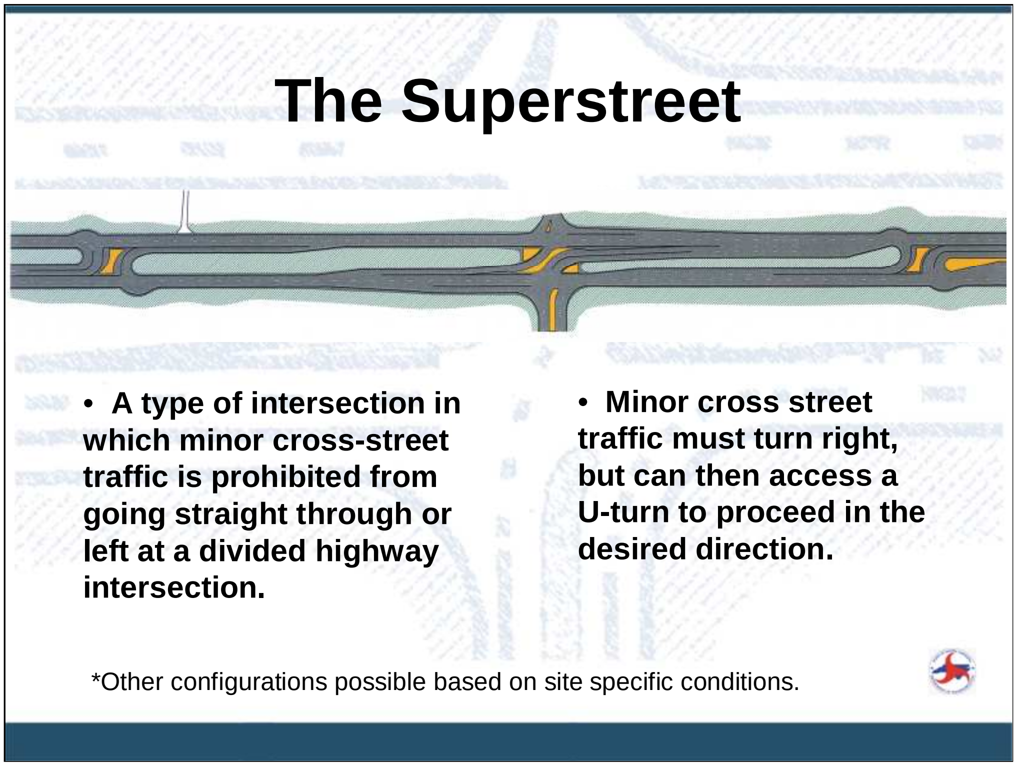


Our core goal at the North Carolina Department of Transportation can be summarized in our mission statement: “Connecting people and places in North Carolina safely and efficiently with accountability and environmental sensitivity.” Indeed, our transportation roadway network is vital for the economic and social successes of our great State.

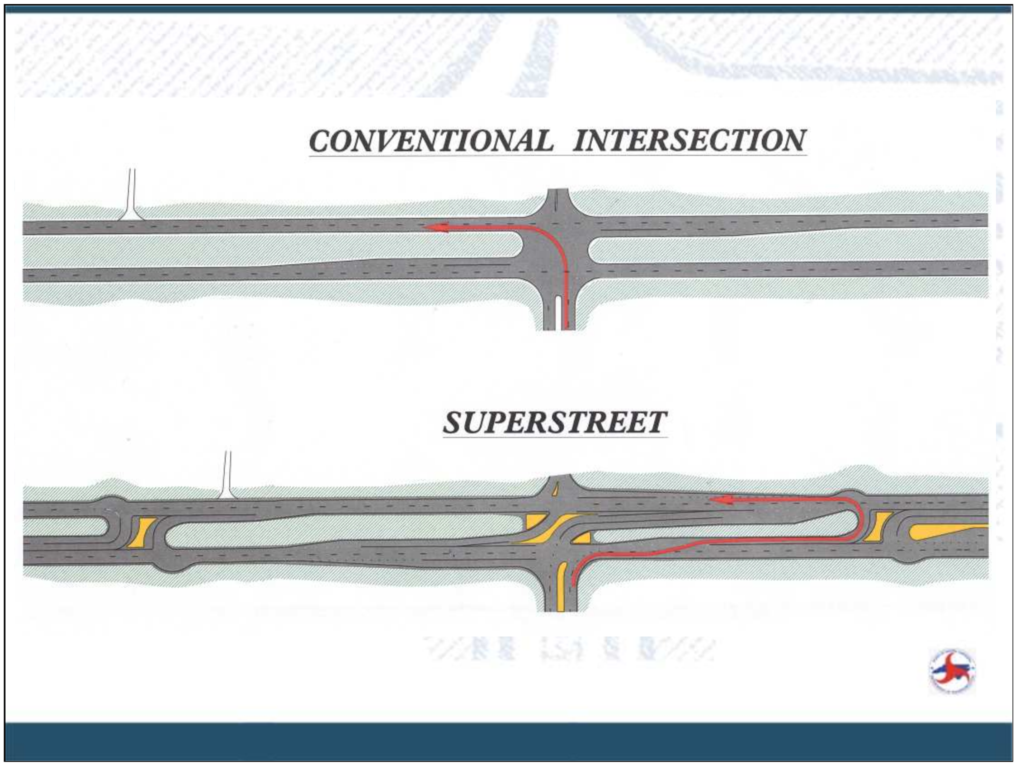
Through our roadway network, goods are brought to market, tourists travel to our many historic and recreational attractions, and residents access their medical care, schools, and churches. Therefore, it is not an exaggeration that the economic vitality and growth of North Carolina and its communities are dependent upon our roadway network. The Department of Transportation continuously strives to safely and efficiently maintain mobility, promote effective construction and expansion of our roadways and seek out new methods and practices to meet the demands of North Carolina’s traveling public.

Just to reframe everyone's perspective, 2006 data shows North Carolina maintains over 79,000 miles, or almost 169,000 lane-miles, of roadway, structures, and traffic control devices. We are ranked second only to Texas for the number of state-maintained lane-miles, but we are ranked forty-seventh for revenue per lane mile. Additionally, the US Census Bureau’s July 2007 figures show the State’s population has now exceeded 9 million. This represents an increase of 12.6 percent just since year 2000 making North Carolina the 6th fastest growing state between the years of 2000 and 2007. For comparison, the national growth rate remains close to 7.2 percent. The momentum of this rapid growth has made North Carolina the nation's 10th most populous state.

The challenges facing the Department of Transportation in an inflation driven economy becomes very clear when faced with these real-world reminders of our expanding responsibilities toward maintaining our State’s investment in its infrastructure and providing services for a booming population. It is with due diligence the Department endeavors to meet these challenges through the continued exploration and application of new methods and practices available to the transportation industry across the country and abroad. The **Superstreet** is one such application.

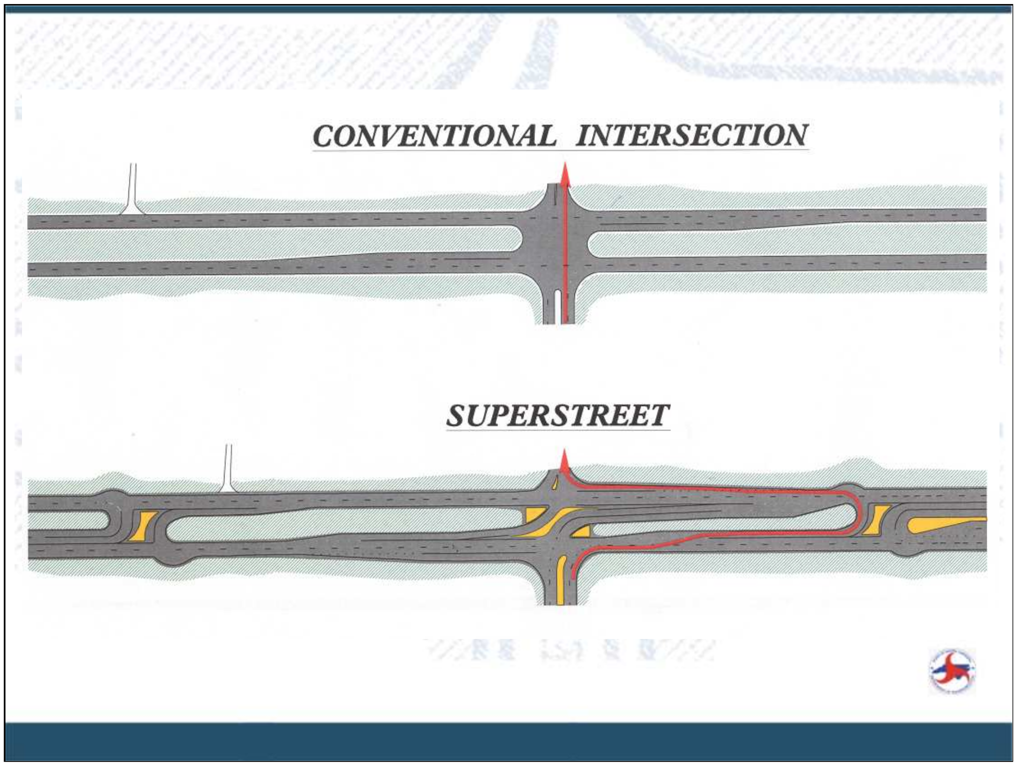


As stated earlier, the **Superstreet** concept refers to a reconfiguration of a traditional intersection. Simply put, it is a method to safely and efficiently manage high traffic volumes at intersections with multiple approaches along a divided highway. The **Superstreet** functions by redirecting through and left turning traffic on the side street approach to turn right, proceed to the nearby U-turn and then return to its original course. At first, this may seem to be a complex solution to a very simple objective – to cross the intersection or to make a left turn. However, I think you will see as we proceed that what seems complex, when designed correctly, is actually a simple and safe solution to the problems caused by congestion.

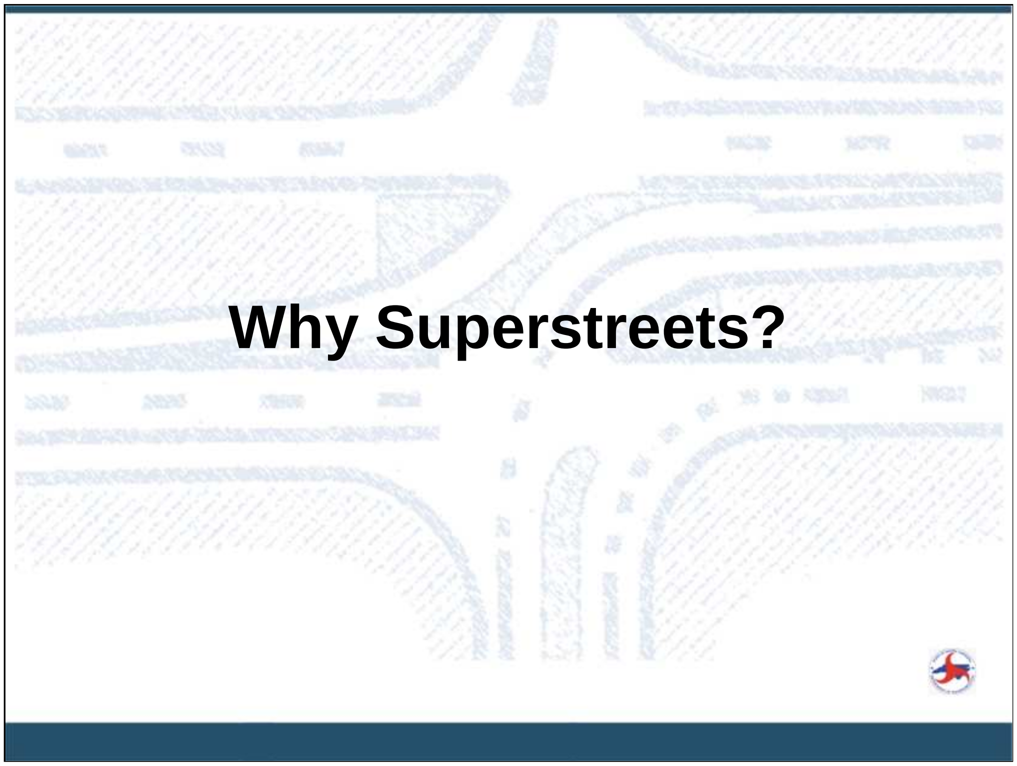


Here, we see the basic lane configurations and intersection geometrics for both the conventional intersection and a **superstreet** intersection along a typical divided highway. There are two basic physical differences in terms of asphalt and concrete between the two types of intersections. The first, and most obvious, are the additional U-turns positioned to the left and to the right of the primary intersection. The distance between the primary intersection and the U-turn is generally specified to be within 600 to 1000 feet. The second is the addition of raised islands in the median areas. These are used to channelize traffic flow safely through the lane configurations.

The first example shown on the screen depicts a familiar left turn movement approaching the intersection from the side street in an attempt to turn left. Below, in the **Superstreet** configuration, left turning traffic is redirected to the right where motorists maneuver into the designated U-turn lane and navigate the U-turn in order to continue along the divided highway in the preferred direction.



Likewise, in the **superstreet** configuration, traffic attempting to travel through the intersection and continue along the side street is also redirected to the right where motorists then merge into the designated U-turn lane, navigate the U-turn and turn right onto the side street. Therefore, full accessibility is maintained for all traffic movements at the **superstreet** intersection.



Now that we have established a good understanding of **how** the new tool in the toolbox works, let's explore **why** it works. The best place to begin that process is with the question:

Why do we use superstreets?

Why do we use superstreets?

To:

Improved Safety;

Less Travel Time;

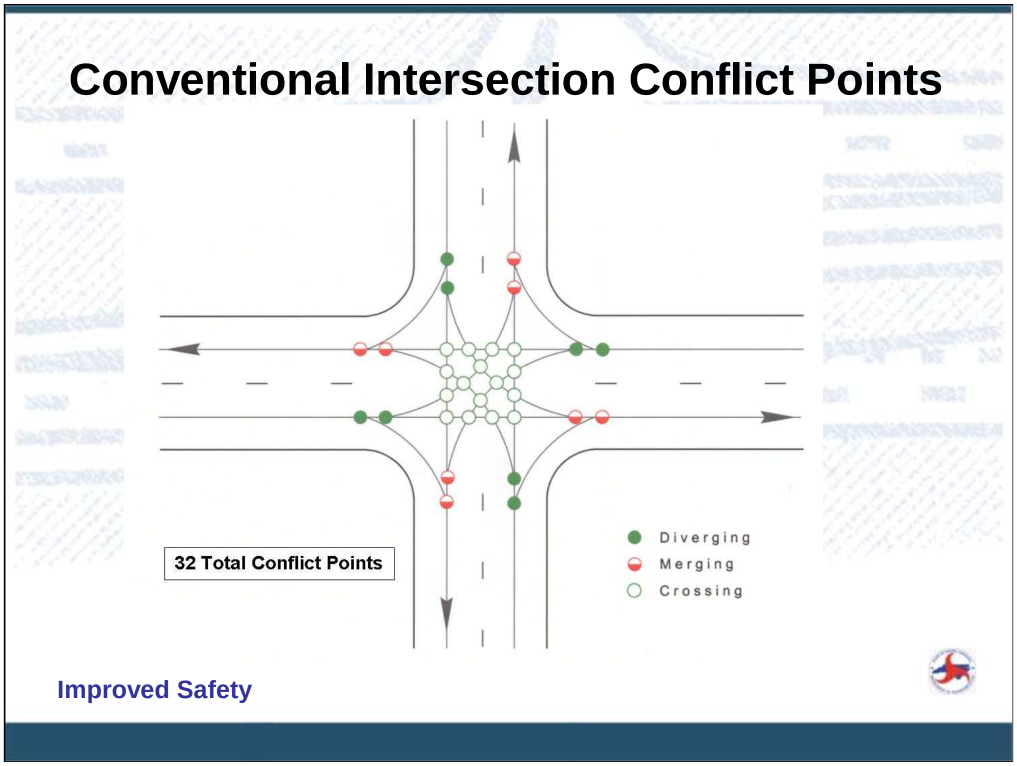
Economically Beneficial; **and**

Environmentally Responsible

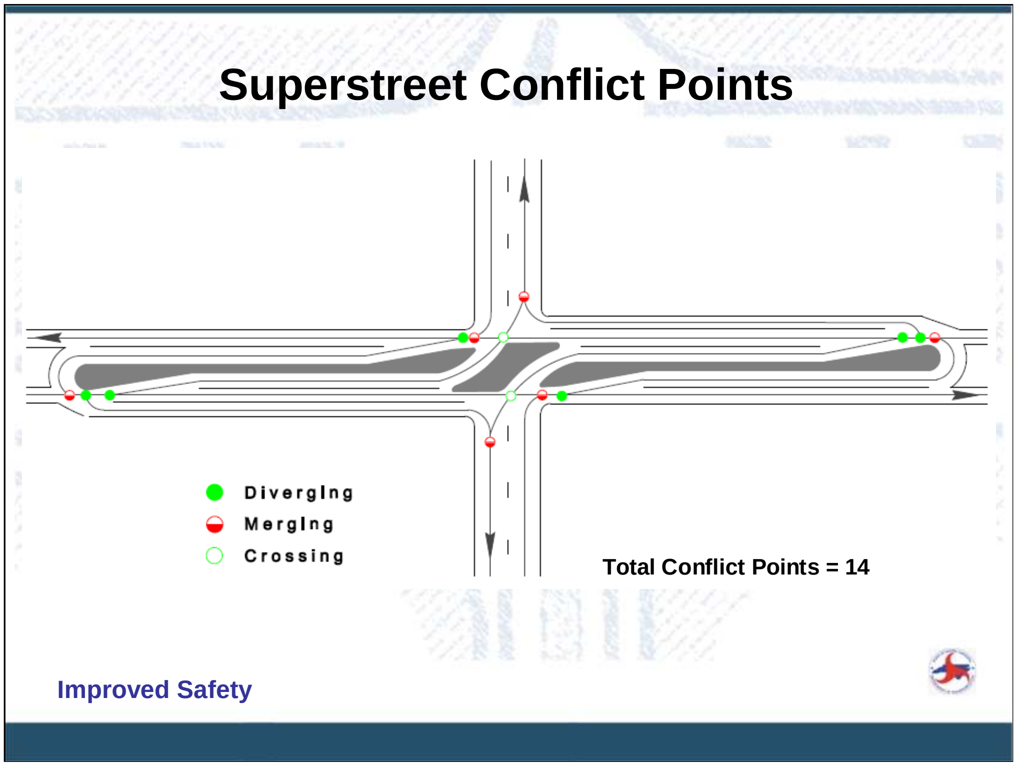
All four of these objectives project personal meanings for both the public and the Department of Transportation. For motorists, they mean arriving safely and on time to offices, schools and homes while enhancing the communities where we live. For our Department, it means effectively optimizing the capacity of our existing resources to safely and efficiently connect the traveling public with the places they need to go. It means making sure we have explored every alternative to insure financial accountability as well as environmental sensitivity. It means keeping our promise to the public and it means delivering our core values to the street.

At the North Carolina Department of Transportation, safety is our number one priority. The implementation of the **superstreet** concept by the Department reflects our dedication and continued efforts to protect public safety. **superstreets** reduce the risk of crashes and specifically the risk of severe crashes such as side-collisions or T-bone type accidents. Since the **superstreet** concept eliminates the two movements that are statistically considered a higher risk for serious injury – side street throughs and lefts -- the likelihood of severe and fatal incidents at the **superstreet** intersection are therefore reduced.

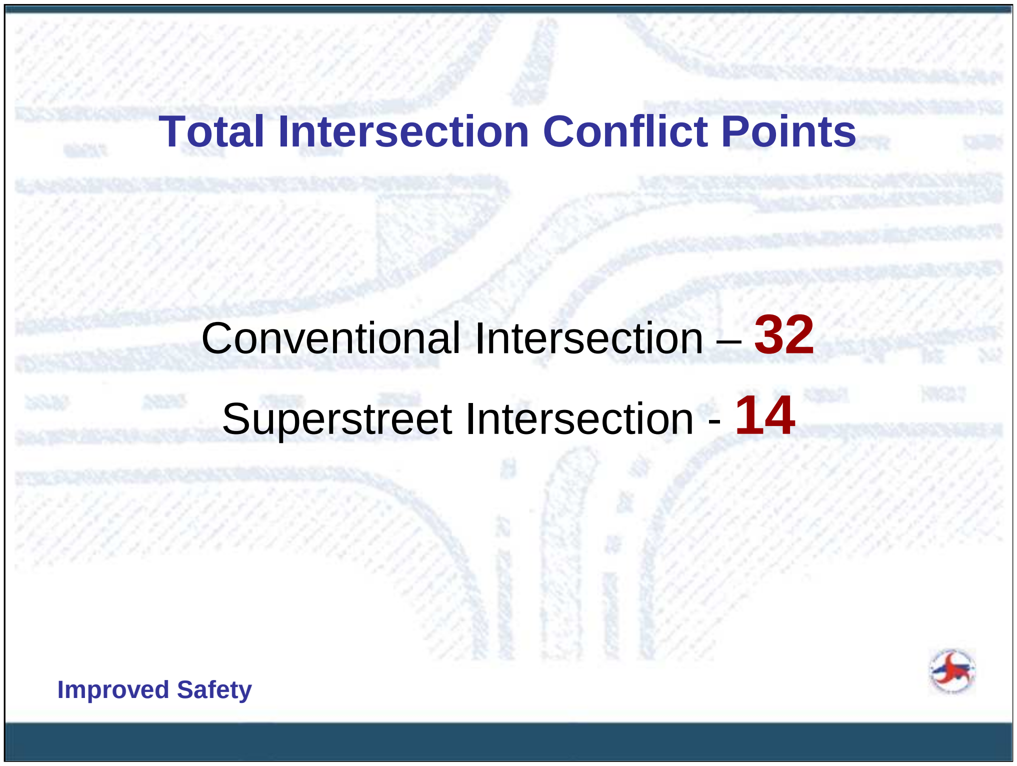
For the same reasons, pedestrians also benefit from the safety features of **superstreets**. Due to the simplification of traffic flow and the reduction of potential conflicts with turning vehicles, pedestrian safety is considerably improved.



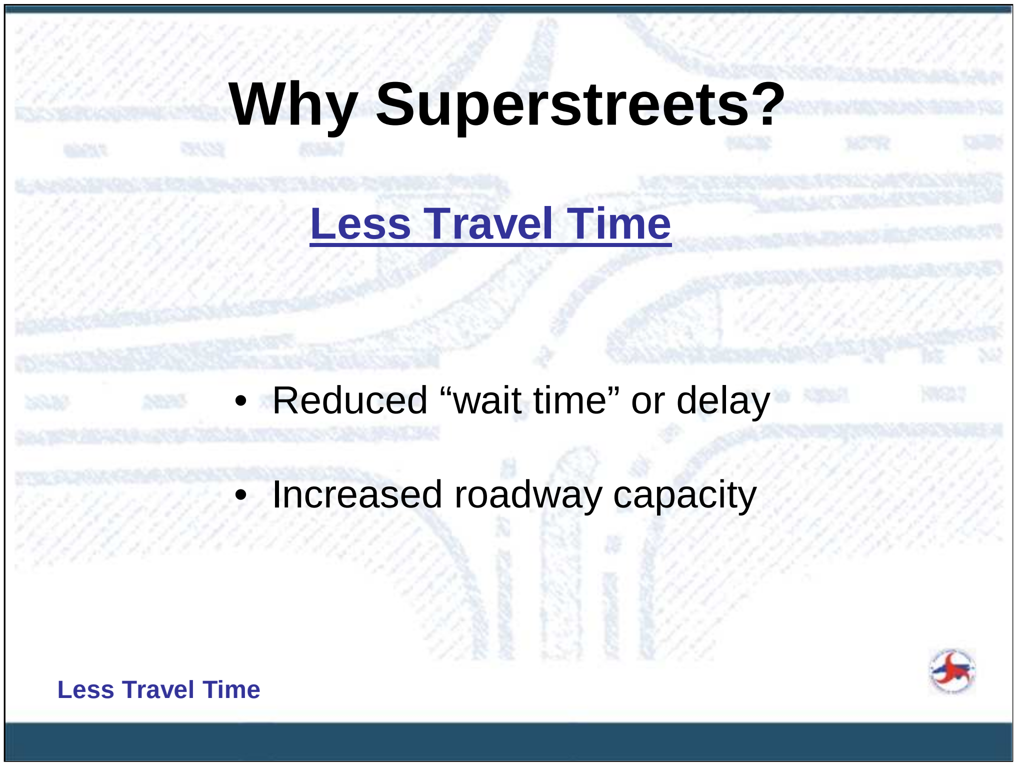
This illustration shows all the potential points where vehicles moving in conflicting directions may intersect, or crash. These “conflict points” are represented by the green, red and white circles that also indicate crash type. As you can see, there is a web of potential conflict points for the conventional intersection -- **32** to be exact. Collisions between vehicles traveling perpendicular to one another statistically result in the most severe injuries as drivers and/or passengers receive the brunt of impact from the side where they are the least protected. The **superstreet** effectively reduces severe crash types by eliminating left turning traffic from the side streets.



Here we have the same illustration for the **superstreet** with all the potential conflict points identified. As you can see, there is a dramatic reduction in the number of conflict points -- almost 50 percent. This translates to a significant reduction in risk to motorists. Looking at the diagram, conflict points resulting from perpendicular traffic movements are either eliminated or disbursed to avoid the high-risk, T-bone crashes.

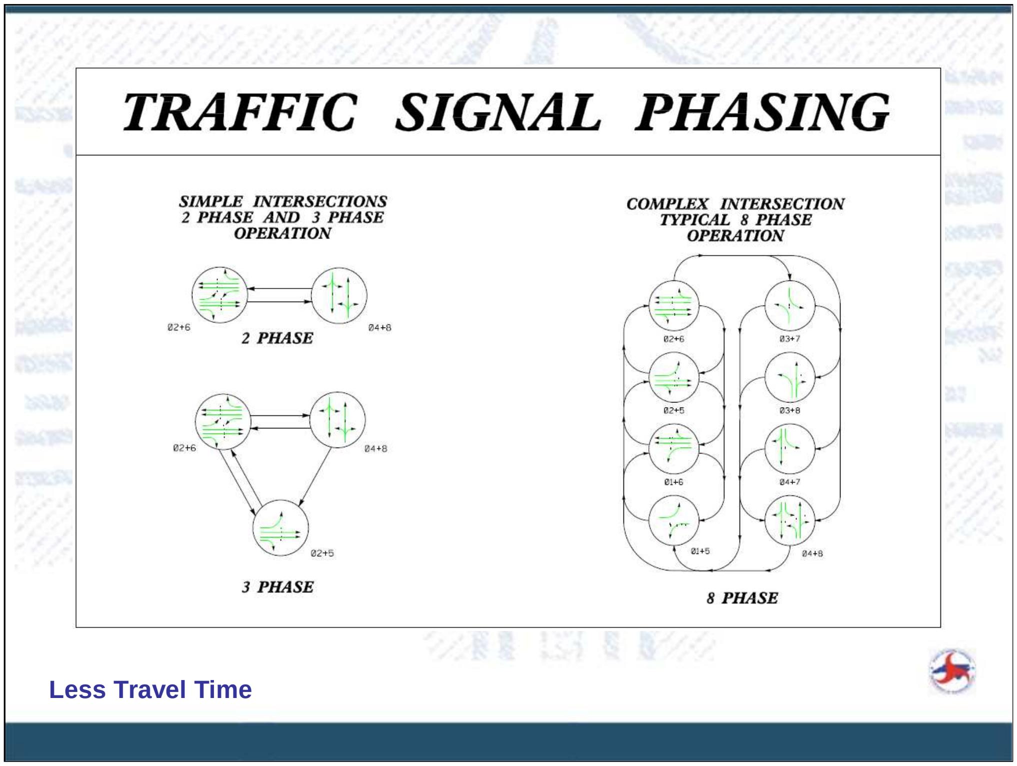


The safety aspect of the **superstreet** is one that warrants reiteration and emphasis. To summarize, a conventional intersection has **32** conflict points versus a **superstreet's 14**. Since there are fewer conflict points, there are fewer opportunities for collision. Likewise, since the high risk movements have been redirected, the **superstreet** also lowers the risk of severe injuries and fatal crashes, most notably side-impact type collisions.



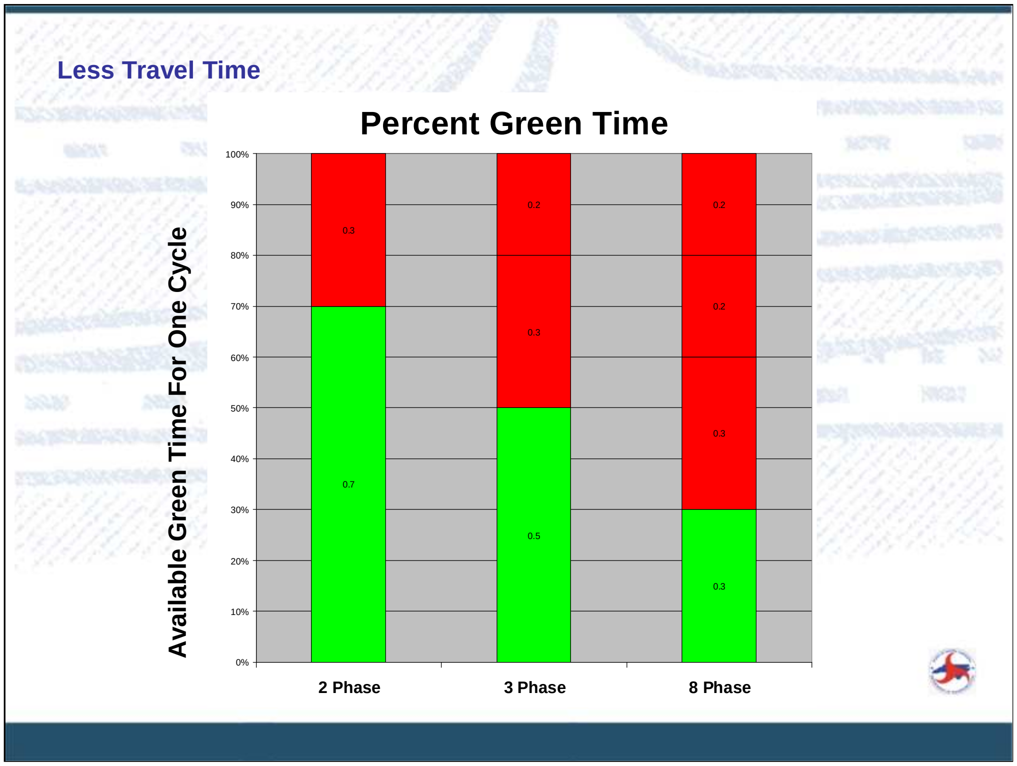
To say **superstreets** reduce travel time may seem a strange idea after seeing that vehicles attempting to turn left or go straight though an intersection from a side street are actually redirected to a U-turn roughly 600 to 1000 feet away and are then channeled back toward the intersection to complete their movement. However, everyone can appreciate the value of spending less time waiting at a traffic signal for the red light to turn green.

For practical purposes, let's use the term "wait time" as time you are delayed, or "delay" time. It would make sense then to say that the more "delaytime," you have at an intersection; the more time it takes to travel to your destination. So, more delay yields longer travel time. The **superstreet** concept was designed to decrease the time vehicles are stopped at the intersection thereby decreasing travel time. If the time a vehicle remains stopped is reduced, then traffic "flow," or progression, is also improved. A positive effect begins to domino along the roadway corridor because better flow translates into the ability to manage more vehicles with the existing roadway. In effect, it optimizes the use of an existing roadway system and reduces both delay and travel time through intersections.



To explain how **superstreets** accomplish this feat, we need to examine how traffic is controlled at signalized intersections. The simplest intersection would be one controlled by signage and traffic flows with minimal to no delay. When the number of vehicles increases beyond the volume in which motorists can safely maneuver the intersection or delays exceed what is reasonable; the intersection graduates to signalized control and a traffic signal is installed. The traffic signal assigns which lanes are allowed to advance through the intersection based on traffic volumes and the number of lanes from each approach of the intersection.

If we define all of the traffic movements {lefts, throughs and rights} that are assigned "green time" simultaneously as one "phase," then a traffic signal can be categorized based on the number of phases it operates. Referring to the slide, there are three examples shown of traffic signal operation. The first image depicts a two phase signal where “green time” alternates between the main street and the side street. From the arrows in the diagram, you can see the lefts, throughs and rights in both directions, one street at a time, are permitted to advance through the intersection. The second image is very similar. As above, lefts, throughs and rights from both directions, one street at a time, are again permitted to advance through the intersection, but a third phase is also added to ensure that the left turning vehicles from a designated approach are allowed some amount of green time with no opposing traffic. This is considered a three phase signal. The third and final image is an example of signal operation at a typical urban intersection with multilane approaches and traffic volumes that require the left, through and right movements of each approach to be separated into different phases in order to maintain safety and traffic flow. This is an example of an eight phase signal.



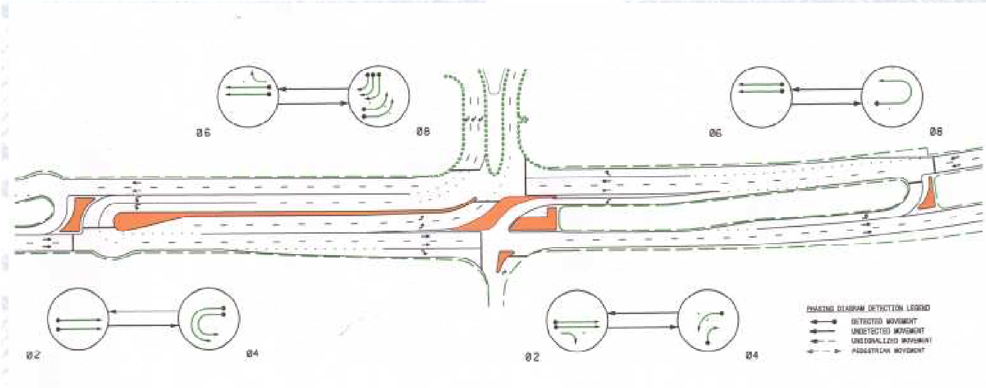
Now, the reason terms like delay, flow, green time and phase are relevant to today's presentation is because the **superstreet** concept is based upon the relationship between the number of phases an intersection manages and the amount of available green time that allows traffic to flow. Once a vehicle receives a red indication and is stopped at the intersection, delay for the motorist begins. As traffic engineers, if we can achieve longer green times and reduce the delay, we can optimize the operation of our intersections and roadways. Looking at the graph, you can see that the fewer phases controlling the intersection, the more green time is available for the progression of traffic.

For example, if a motorist is stopped at a two phase signal, then the wait time is fairly short because only one other phase has to cycle through the intersection before the right-of-way returns to the waiting motorist. The available green time that the intersection receives is divided only between the two phases. So, green time remains greater than the time the motorist is stopped and waiting.

The same philosophy holds for a three phase signal. Even though there is an additional phase to protect left turning vehicles, the wait time is still reasonable with only two other phases cycling through the intersection. Green time is reduced slightly and the time the motorist spends waiting is about equal to the time the motorist is given to progress through the intersection. Therefore, two and three phase signals are very effective for maintaining traffic flow and reducing travel time.

However, when traffic volumes increase and the number of lanes required to safely move traffic through the intersection exceeds the capacity of two and three phase signals, more phases must be added. Specifically, left turn movements must be isolated and protected from on-coming traffic. Hence, the more phases that are added, the more time the motorist spends waiting for the additional phases to cycle through. When operation of an eight phase signal is warranted, delay for the motorist is much longer, available green time is significantly less and driver frustration begins to increase. Engineers reach for tools like **superstreets** when even eight phase traffic signals cannot effectively manage driver demands on the roadway system.

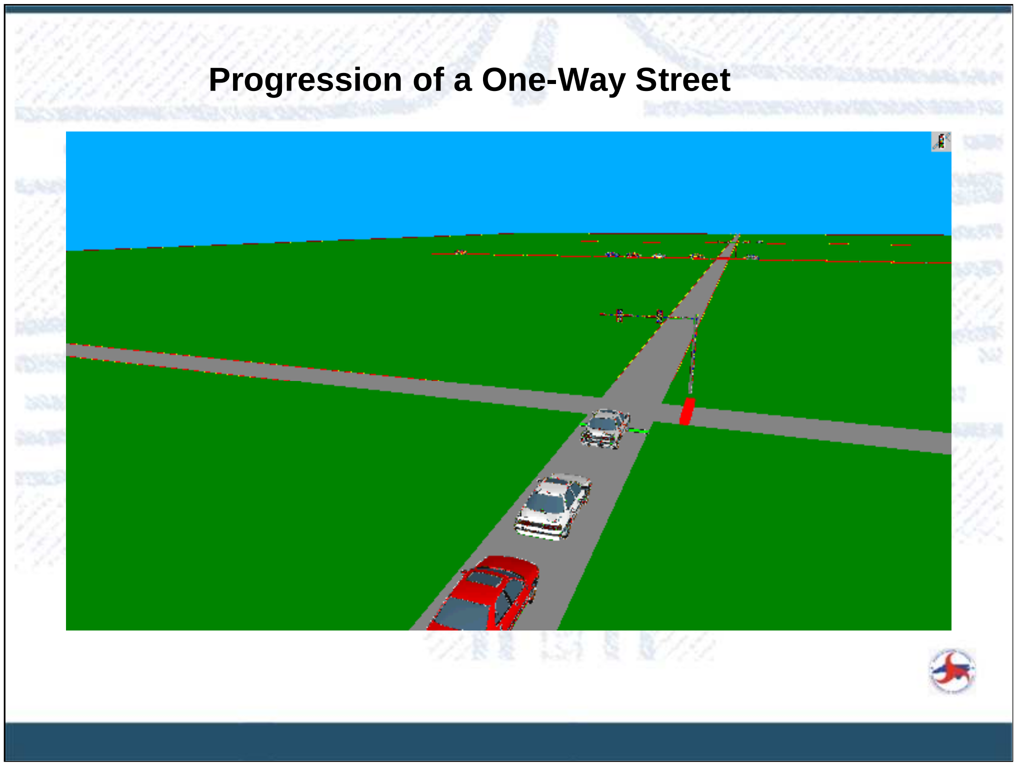
Superstreet Phasing



Less Travel Time

This diagram shows the phasing sequence of the **superstreet**. The **superstreet** essentially takes the operation of an intersection that has moved beyond the functional capacity of eight phase operation and divides the eight phases into four separate intersections each operating as a two phase signal. In effect, this restores the longer green times, re-establishes progressive traffic flow and once again reduces delay at the intersection.

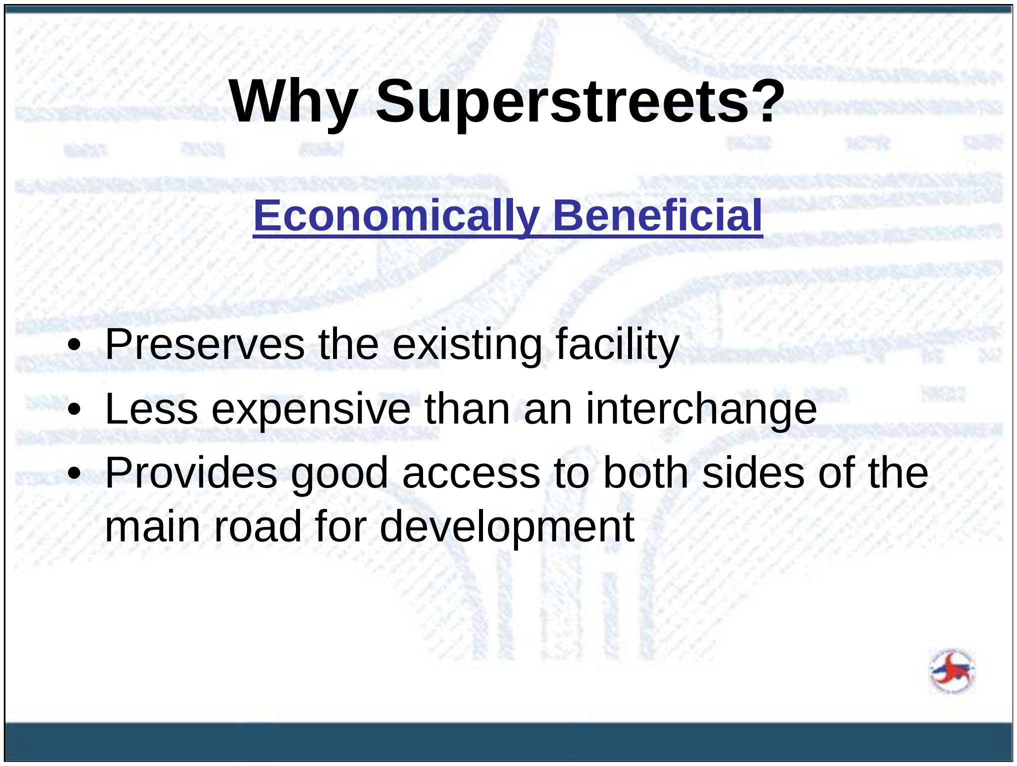
Breaking down the signal phases this way, also allows engineers to work with the traffic flow in each direction of the main street separately. This makes timing traffic progression from intersection to intersection much less complicated and optimal conditions much easier to program. For motorists, this translates to fewer stops.



Sounds great, but does it really work? As we mentioned previously, the first signalized **superstreet** in the country was implemented in Leland, NC in 2006. Many different alternatives for mitigating congestion were considered to accommodate the development forecasted for areas along US 17. One method used by engineers to compare these alternatives, examines the flow of traffic along a corridor -- meaning along the entire length of a street or highway. The analysis follows a group of cars advancing through the corridor as a unit, or platoon. Once a platoon of cars begins to move through a corridor, the effectiveness of the traffic control is measured by the amount of time the platoon progresses without being stopped. The longer the platoon remains moving, the more effective the method of traffic control is considered to be.

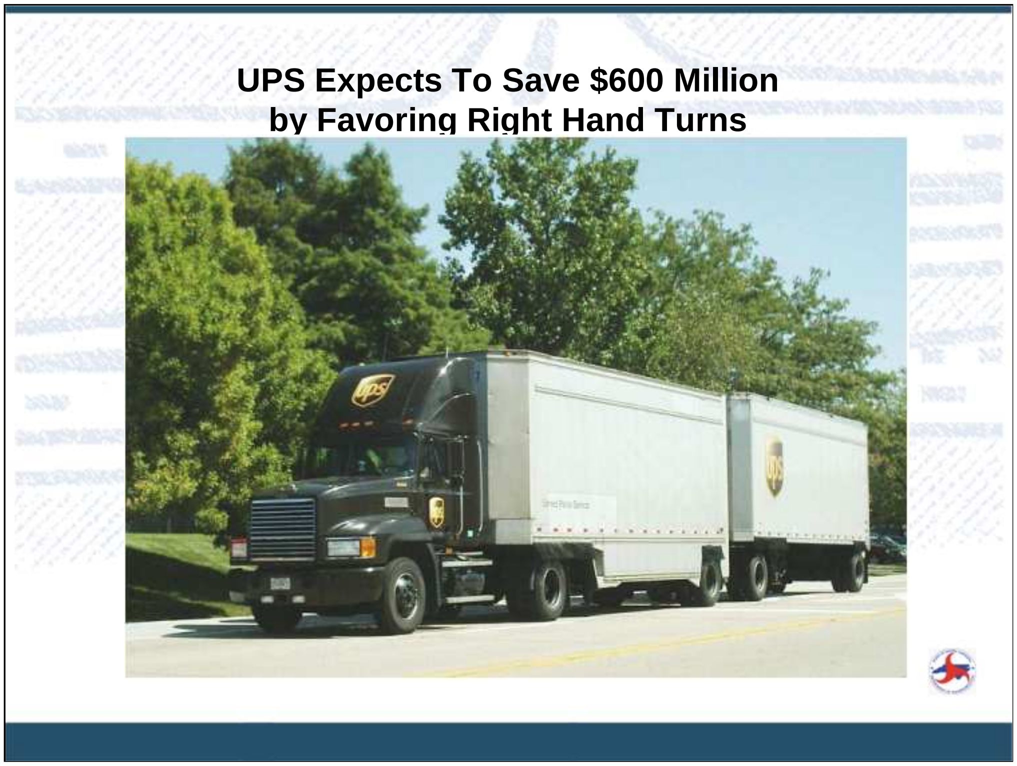
A familiar example of this type of progression might be found on a one-way street through a downtown area similar to the example above. If the traffic signals are timed well, a platoon of cars traveling at the posted speed would progress through the length of the street with minimal stops.

Going back to the US 17 corridor, design alternatives were compared using programmed simulations of platoon traffic moving along the corridor with the forecasted traffic volumes to see which alternatives promoted the most effective progression of traffic. In other words, which alternative enabled a platoon of cars to move through the corridor with the fewest number of stops and the least delay in travel time. Based on the simulation for the US 17 corridor, the amount of green time given to the main street increased from 50 seconds with a traditional intersection to 90 seconds with the **superstreet** configuration given the same traffic conditions. Operating since 2006, the US 17 corridor has proven to be as effective on the street as it was in design. So, the answer to the question, "Does it work? is an emphatic, "Yes!"



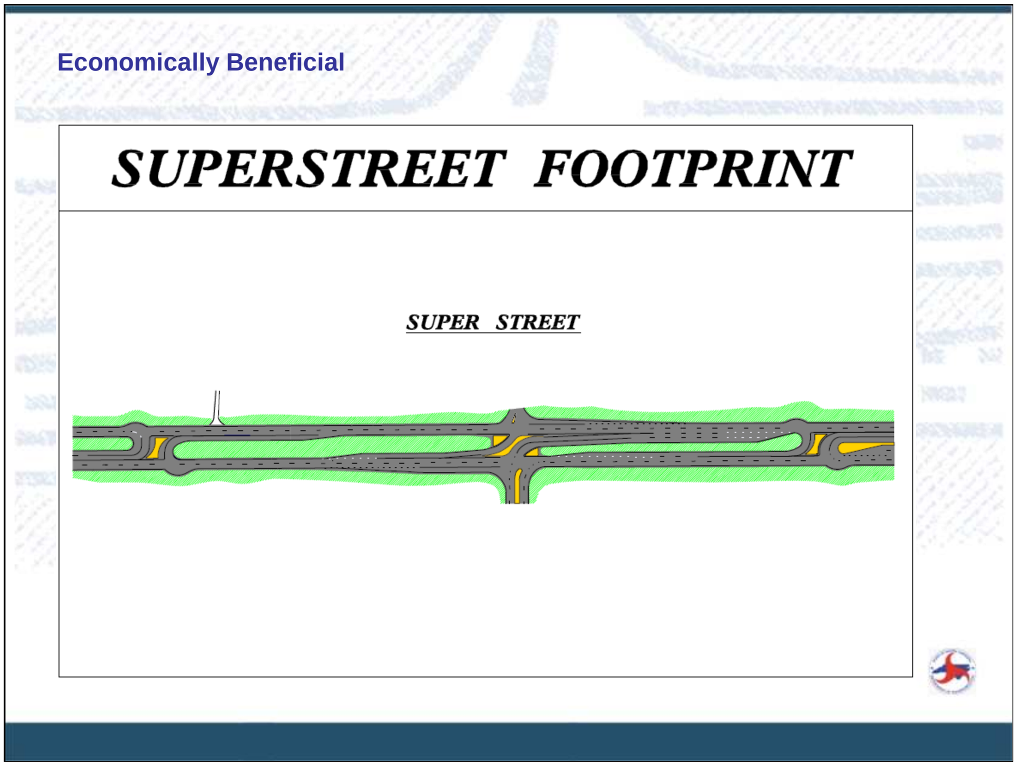
Alternatives -- this is a word we hear everyday in engineering as it applies to projects, designs and budgets. It has many different applications, but inevitably it means **creating** the **opportunity** for **choice**. The Department of Transportation diligently seeks to serve the public and protect the interests of our State by exploring, analyzing and providing alternatives. We explore alternative solutions like the **superstreet** to ensure we are delivering the most cost effective answers to the challenges facing our State's transportation infrastructure; we analyze alternative designs for each project to ensure economic accountability of the public's investment in their roadways; and we are providing alternatives that reflect the future instead of the past and emphasize our **choice** to lead the State in revitalizing our roadway network.

From an economic view point, the **superstreet** provides the State with an effective tool for reducing construction costs. In the past, when a conventional intersection had become ineffective and operated at unacceptable levels of delay, it was common practice to consider an interchange to relieve congestion. Fortunately, we now have a **choice** which preserves the existing roadway, delays or potentially eliminates the need for an interchange and provides balanced access to both sides of the roadway.

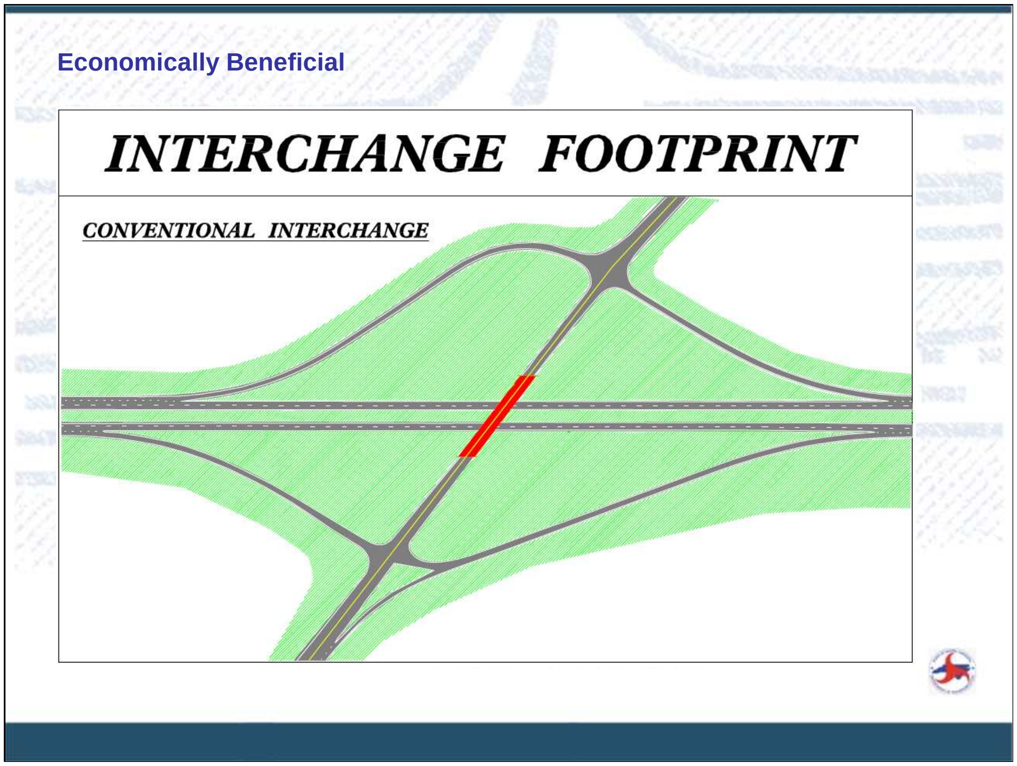


In light of recent events, the impacts of rising fuel costs have far reaching impacts on the citizens and business that support our North Carolina communities. For companies who are dependent on the delivery of goods and services, profitability is closely linked to fuel conservation. Articles outlining corporate America's recognition of the fiscal impacts of congestion have been prevalent in the news for several years. However, UPS has even recognized the correlation between fuel consumption and the delay of left turn phasing. The following excerpt was taken from one such article and emphasizes how **superstreets** can be used to support North Carolina's business community:

Companies like UPS have taken a hit in the last couple of years as a result of rising fuel costs. Now the brown trucks of UPS are going to be getting their routes optimized to help save money. UPS delivers over 14.5 million packages a day and the trucks tend to have routes that are rarely the same. The company will be using package flow technologies to optimize the loading of packages so drivers can get them out in order, more quickly, reducing the idle time. They will also set up the daily routes, to favor right hand turns where possible, again to reduce running time. The less time trucks spend sitting in left turn lanes, the less fuel they burn. UPS is projecting savings of $600 million a year from the changes.



Conversion from a divided highway facility to a **superstreet** configuration requires only minimal roadway construction and right-of-way procurement. The "footprint" of a typical **superstreet** intersection can be contained within an area of ten acres. The total expense to the public averages close to 1.5 million dollars with design and deployment complete within 12 months.



However, this is not the case for a conventional interchange which requires significant construction. The "footprint" for a typical interchange can impact as much as 90 acres with total expense to the public reaching more than 7 million dollars to construct. Introducing bridge construction significantly lengthens the construction schedule and delivery can take from 18 months to 2 years.

As North Carolina's population continues to grow and development increases along our highway system, the focus on environmental responsibility takes center stage as a vital design element in every aspect of today's transportation industry -- in planning, design, construction and operation.

The **superstreet** concept is an excellent example of environmentally sensitive design sometimes referred to as building "green." Common goals for design using this philosophy apply across every discipline of engineering and include protection of natural resources and environment, optimizing existing facilities, recycling resources, spreading environmental impacts over long-range projects, creating communities versus sprawl and encouraging mix-use development and multi-modal transportation access.

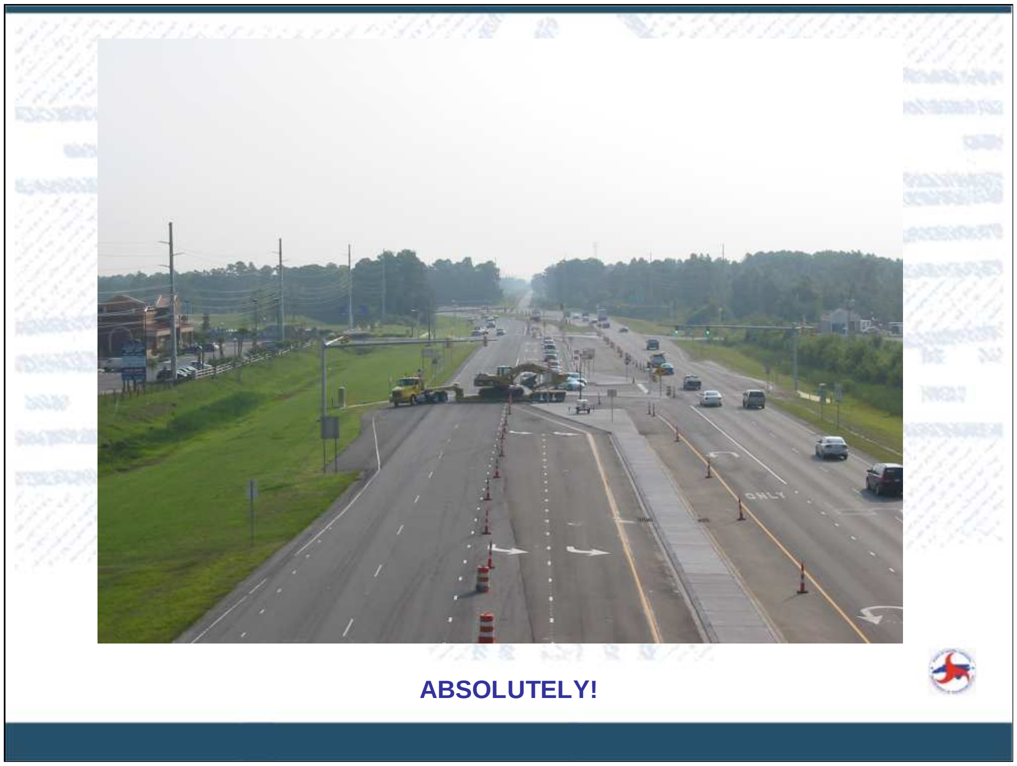
You may already recognize some of the attributes of Green Design as they applied to previous **superstreet** objectives. The operation of **superstreets** plays an important role in reducing environmental impacts in several ways. We saw how **superstreets** reduced the amount of time vehicles remain stopped and how this improves progression through the entire corridors. This results in less time vehicles spend idling. Therefore, fewer pollutants from exhaust are released into the atmosphere, air quality is improved and fuel consumption is also conserved. These savings have far reaching impacts for our State, our citizens and for our business communities. For companies like UPS who are dependent on delivery of goods and services, profitability is closely linked to fuel conservation and efficient routing.

We also saw a significant difference in the physical footprint of **superstreets** as compared to interchange alternatives. Ten acres of land use impacts versus ninety acres of drainage design, bulldozing, service roads and access control create a vivid depiction of environmental advantages.

Additionally, **superstreets** can delay or potentially eliminate the need for interchange construction while optimizing the capacity of the existing roadway. Access to local business and community interests are facilitated equally on both sides of the **superstreet** creating safer entrances and exits onto and from development sites. Both pedestrians and multi-modal transportation users are safely and efficiently accommodated. Ultimately, these designs can facilitate the development of communities and mix-use centers where retail, commercial and resident amenities are easily merged.

One question that usually arises over the introduction of the **superstreet** is the concern for Semi-trailer combinations – specifically at the U-turn intersections.

Can **superstreets** accommodate Semi-trailers?



Absolutely!

As you can see from the image, U-turns are designed with additional asphalt to allow semi-trailer combinations ample room to complete the U-turn.

And, again, here you can see the semi-trailer has no trouble maneuvering the U-turn.

The **superstreet** concept is very versatile and its use does not always include heavy traffic volumes. Notice, this intersection is not signalized and is set in a fairly rural area where safety was the predominant concern. Redirecting through and left turning traffic significantly reduced the number of severe accidents at the intersection and required minimal financial outlay for construction.

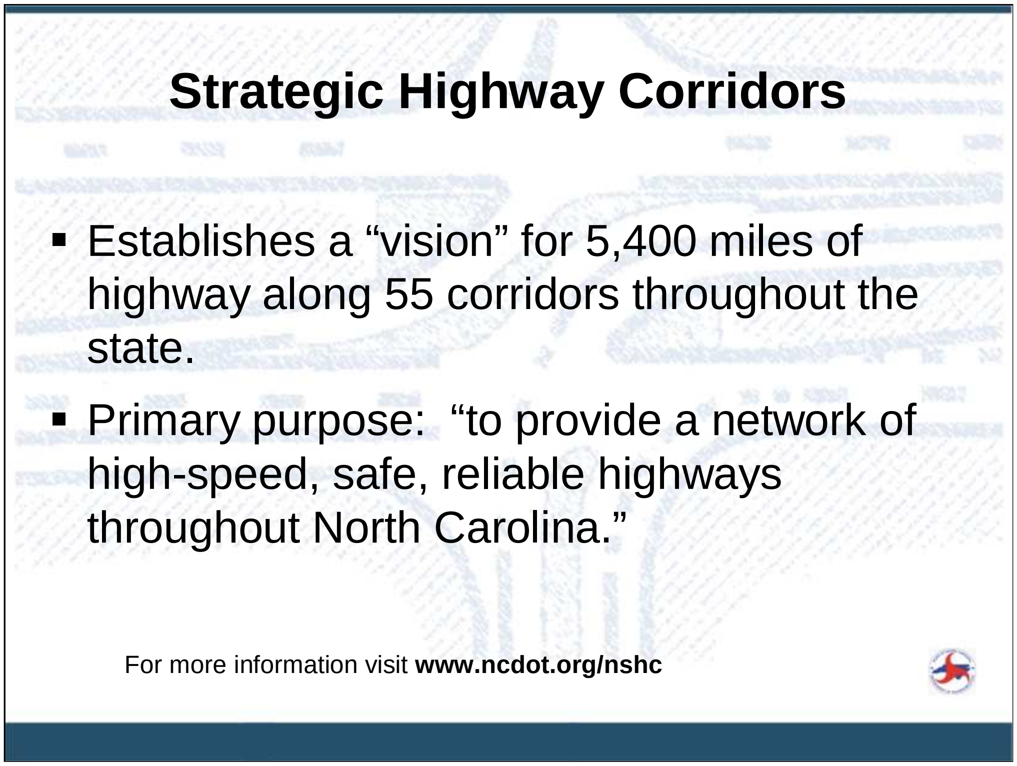
This is an example of a signalized **superstreet**. Although traffic does not appear heavy in the photograph, please note this picture was taken one week before Christmas, in a commercial district where traffic volumes along the corridor are generated from multiple residential developments with over 1000 homes per development, large commercial retailers, and other multi-use development support such as, a medical center, office space and numerous retail centers with restaurants, fast foods, designer shops, and drug stores. The implementation of the **superstreet** has maintained the steady progression of traffic through the corridor and there is no evidence shown of queuing either entering or exiting the shopping center shown above.

The **superstreets** you see here are the first six applications in the State and there are more proposed designs currently in the review. These locations represent either projects where traffic and safety factors warranted **superstreet** application or where **superstreet** design is currently under consideration: (See above)
The first three are signalized and the last three are unsignalized.

The Department of Transportation is committed to providing a safe, efficient and effective transportation system for the State because the economic well being of the people we serve depends upon our success. New demands are being placed on our highway system everyday as our population continues to grow and new industries require affordable access to global markets.

Meeting the transportation needs of our State requires identifying and investing in those roadways and corridors that are critical to sustaining our economic lifelines. Thus, North Carolina established its Strategic Highway Corridors.

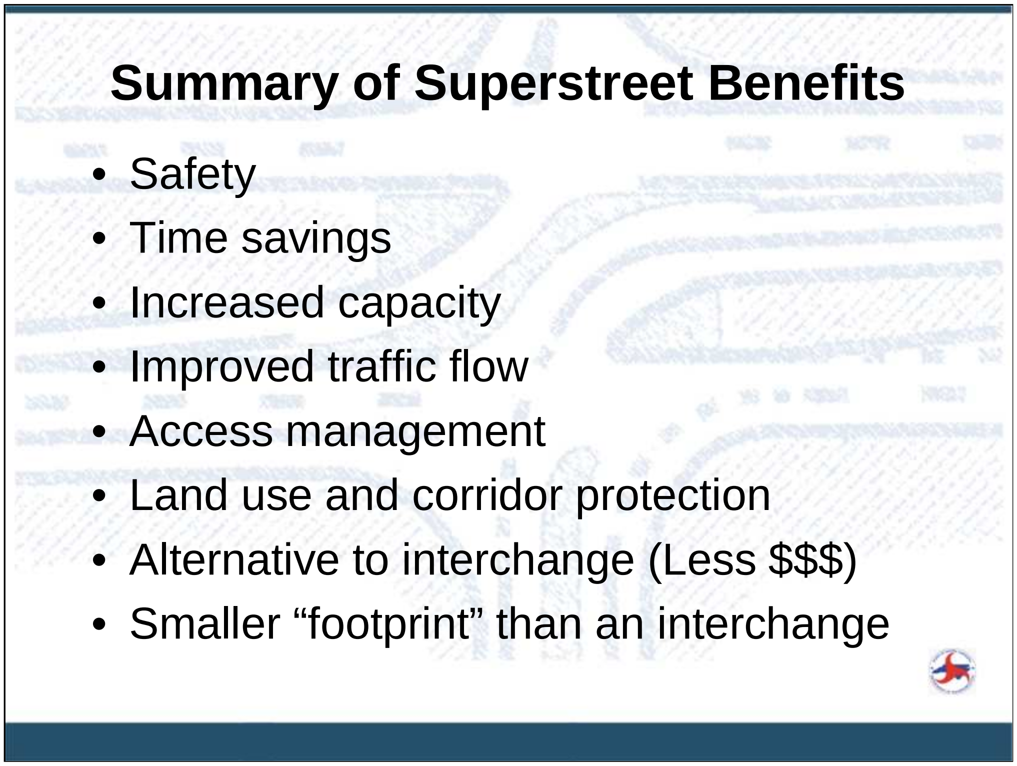
Superstreets are one tool that the Department of Transportation can use to protect these corridors through the enhancement of safety and efficiency in an economically beneficial and environmentally responsible way.



Of our States 79,000 miles of roadway system, approximately 7 percent of those miles were identified as being so critical to our State's transportation system that protection was warranted. There are over 5,400 miles of highway along 55 corridors identified throughout the State. These corridors carry the majority of our State's heavy truck and tourist traffic.

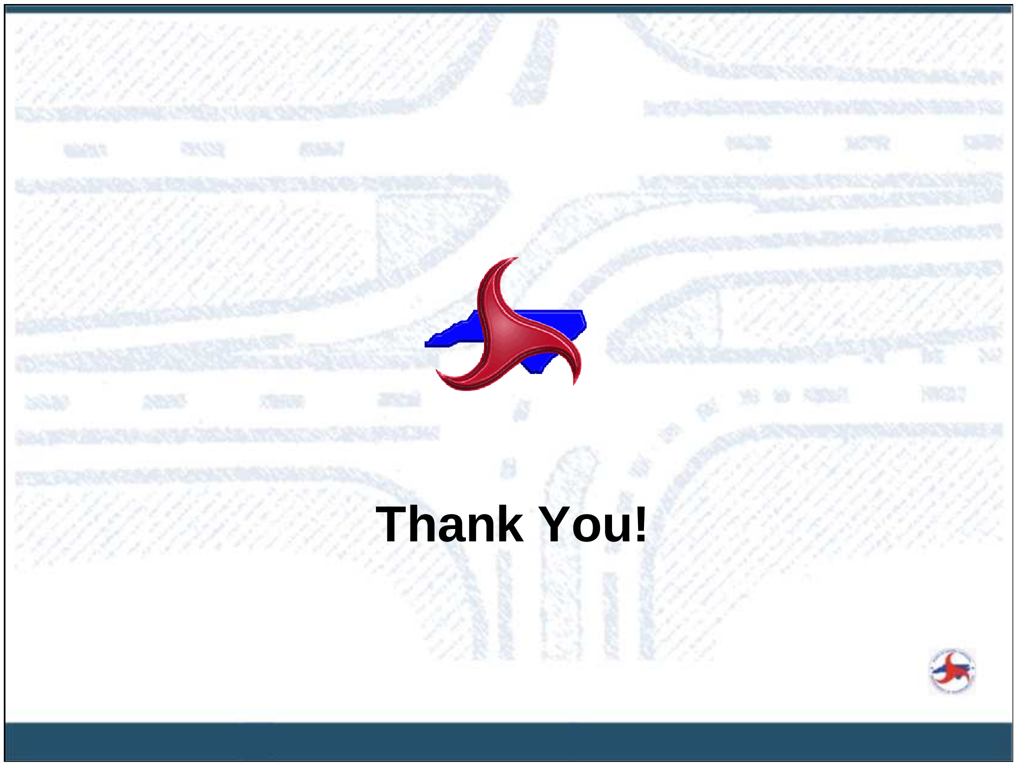
The **superstreet** is one tool at our disposal to help regain and maintain mobility along our State's Strategic Highway Corridors. However, its application is not limited to the highway environment. It is proving just as effective along critical arterials struggling to accommodate the influx of population growth our State is currently experiencing.

This graphic represents the major transportation routes connecting North Carolina with our neighboring states to the north, south and west. The State's diverse natural resources, scenic interests and commercial centers are unilaterally dispersed and distributed alongside of our Strategic Corridors.



We have covered a broad spectrum of information pertaining to the new tool in the Department of Transportation’s tool box. Hopefully, we have also added some interesting facts about the State and what’s new on its transportation system.

I feel confident in closing that when you approach your next **superstreet**, you will maneuver its traffic pattern knowing that the Department of Transportation is striving to make the routes you drive safer and more efficient; your work cost effective and accessible; and the communities and natural resources you build for your families protected and sustainable.



I want to thank you today for coming and for sharing your time with the Department of Transportation. We understand how valuable your time is and appreciate the opportunity share with you our efforts to make traveling in this State a safe and timely journey.

For those of you have time following the presentation, there is an animated simulation of a **superstreet** operation. I invite you to stay for just a few minutes to observe how the **superstreet** mitigates congestion and provides a safe, efficient and environmentally friendly alternative to traffic control.

To better illustrate the flow of traffic through the Superstreet intersection, we have an animated visualization of an operational superstreet.

➢It begins with an aerial overview of a superstreet corridor.

➢Zooming in, you see the u-turns. Notice the additional pavement “bulbs” designed to accommodate recreational vehicles and commercial trucks.

➢Moving down the corridor, we now approach one of the cross street intersections. Here, you see vehicles making a right turn.

➢Now they are moving down the corridor.

➢And into the u-turn bulb, where they make a u-turn and proceeds in the desired direction.

➢Now we go back down the corridor to further observe the cross street intersection.

➢And another view.

➢Final, zooming back out.